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[54] TITLE OF THE UTILITY MODEL: REVERSED F-SHAPED ANTENNA

10

[57] ABSTRACT

The utility model relates to a reversed F-shaped antenna. Under the space limitation of a notebook computer, the utility model calculates a path length of a double-frequency or three-frequency antenna open-circuit end according to the design of the reversed F-shaped antenna, the double-frequency reversed F-shaped antenna is designed according to the space limitation of the notebook computer, the path length from the open-circuit end to a signal feeding end is 1/4 of a wavelength emitted from the antenna, and antennas with different frequencies have different path lengths.

## CLAIMS

1. A double-frequency reversed F-shaped antenna that is used for wireless reception and transmission of a notebook computer and is designed be able to be radiated at an edge of the notebook computer, comprising:
  - a feeding end that is bonded to a signal source and feeds voltage signals of a signal source;
  - a short end that is bonded to a ground unit and outputs the voltage signals to the ground unit;
  - a first radiation path that has a first open-circuit end and is designed by one of the frequencies of two voltage signals and is extended to the open-circuit end from the feeding end to have a straight shape; and
  - 15 a second radiation path that has a second open-circuit end and is designed by the other one of the frequencies of the two voltage signals, is extended to the open-circuit end from the feeding end to have a "L" shape, a portion of the "L" shape being shared with the first radiation path, is bonded to the short end by extending the bonding end, and bonds the first radiation path to the short end,
- wherein each of the first radiation path and the second radiation path is used to radiate the two voltage signals corresponding to the two radiation paths and

receive two electro-magnetic waves of a corresponding frequency fed from the outside, the the two voltage signals being fed to the ground unit through the short-end.

5       2. The double-frequency reversed F-type antenna according to claim 1, wherein the area size of the two radiation paths is controlled.

10      3. The double-frequency reversed F-type antenna according to either claim 1 or 2, wherein the open-circuit end that controls the first radiation path and the second radiation path is a squared shape.

15      4. The double-frequency reversed F-type antenna according to claim 1, wherein the two voltage signal frequencies are selected from 0.9 GHz, 1.6 GHz, 1.8 GHz, 2.0 GHz, 2.4 GHz, and 5.2 GHz.

20      5. A three-frequency reversed F-shaped antenna that is used for wireless reception and transmission of a notebook computer and is designed to be able to be radiated at the edge of the notebook computer, comprising:

25      a feeding end that is bonded to a signal source and feeds voltage signals of the signal source;  
          a short end that is bonded to a ground unit and

outputs the voltage signals to the ground unit;

a first radiation path that has a first open-circuit end and is designed by one of the frequencies of three voltage signals and is extended to the open-circuit end  
5 from the feeding end to have a straight shape;

a second radiation path that has a second open-circuit end and is designed by two of the frequencies of two voltage signals, is extended to the open-circuit end from the feeding end to have a straight shape; and

10 a third radiation path that has a third open-circuit end and is designed by three of the frequencies of the two voltage signals, is extended to the open-circuit end from the feeding end to have a "L" shape, a portion of the "L" shape being shared with the first radiation path and the  
15 second radiation path, is bonded to the short end by extending the bonding end, and bonds the first radiation path and the second radiation path to the short end,

wherein each of the first radiation path, the second radiation path, and the third radiation path radiates the  
20 three voltage signals corresponding to the three radiation paths and receives three electro-magnetic waves of a corresponding frequency fed from the outside, the three voltage signals being fed to the ground unit through the short-end, and

25 the three radiation paths having the open-circuit end

whose length is designed based on the frequency of the three voltage signals radiate the three voltage signals corresponding to the three radiation paths from the feeding end to the three open-circuit end and receive three 5 electro-magnetic waves of the corresponding frequency fed from the outside, the three voltage signals being fed to the ground unit through the short-end.

6. The three-frequency reversed F-type antenna  
10 according to claim 5, wherein the area size of the three radiation paths is controlled.

7. The double-frequency reversed F-type antenna  
according to claim 1, wherein the open-circuit end that  
15 controls the second radiation path and the third radiation path is a squared shape.

8. The double-frequency reversed F-type antenna  
according to claim 1, wherein the open-circuit end that  
20 controls the third radiation path is a squared shape.

9. The three-frequency reversed F-type antenna  
according to claim 5, wherein the three voltage signal  
frequencies are selected from 0.9 GHz, 1.6 GHz, 1.8 GHz,  
25 2.0 GHz, 2.4 GHz, and 5.2 GHz.

## DESCRIPTION

## REVERSED F-SHAPED ANTENNA

## 5 Technical Field

The utility model relates to an antenna, and in particular, to a double-frequency reversed F-shaped antenna used in a notebook computer, which is a reversed F-shaped antenna.

10

## Background Art

Communication products, such as mobile phones that are currently being marketed, have gradually reduced in size. Further, communication products have been integrated 15 into other electronic products, for example, notebook computers, personal digital assistants (PDAs), etc. When devices are installed into electronic products, the size needs to be further considered. Bluetooth and wireless LAN, which are currently being manufactured by many manufacturers, need to meet the demands of integrating the 20 communication devices into all the electronic devices. Subsequently, the development of the Bluetooth has increased the trend in reducing the size of the communication products.

25 It is necessary to consider an antenna that is an

important factor in order to develop a communication technology. Due to the miniaturization of the communication devices, the antenna should be designed to meet the size of the communication devices. At this time,  
5 with the current development in technology, a method for solving the miniaturization of the antenna is at a mature stage in development. For example, the developed technology of miniaturization of the antenna is applied to a microstrip antenna (thin type antenna), a reversed F-shaped antenna, a high dielectric constant antenna, an aperture antenna, an embedded antenna, a small helical antenna, etc.

In addition, in order to increase a bandwidth, a frequency range set in the communication devices is  
15 increasingly widened in order to be set to a high frequency region. For example, the Bluetooth uses a fundamental frequency of 2.4 GHz, while GSM uses a fundamental frequency of 1.8 GHz, etc. It is necessary to miniaturize the antenna as the frequency is getting higher.

20 Further, researchers have proposed various solutions that operate a single communication device in a plurality of channels in order to adapt a broadband frequency, including research and developing a double-frequency, in particular, a multi-frequency communication device. Among  
25 those, a technical problem to be solved by researchers is

that the miniaturized antenna has the double operation frequency, in particular, the multi operation frequency.

All the portable electronic facilities, such as the notebook computer, have many metal structures. The metal structure shields electro-magnetic wave noise (EMI) to reflect the radiation of the antenna. For this reason, many factors should be considered at the time of designing the antenna to be built in the notebook computer, which is more difficult than designing the antenna in free space.

10 However, since both frequency characteristics and field patterns are changed, it is very difficult to design the double-frequency or the multi-frequency antenna to be built in the notebook computer.

15 Disclosure

In consideration of the above technical problems of the related art, it is a main object of the utility model to provide a reversed F-shaped antenna that can be used for a notebook computer and can be designed in double-frequency or multi-frequency according to actual demand.

It is another main object of the utility model to provide a reversed F-shaped antenna that implements impedance balance matching by controlling an area size of a radiation path.

25 It is still another main object of the utility model

to provide a reversed F-shaped antenna with an increased bandwidth by controlling an area size of a radiation path.

In order to achieve the above objects, there is provided a double-frequency reversed F-shaped antenna that is used for wireless reception and transmission of a notebook computer and is designed to be able to be radiated at an edge of the notebook computer, including: a feeding end that is bonded to a signal source and feeds two voltage signals; a short end that is bonded to a ground unit and outputs the two voltage signals to the ground unit; a first radiation path that has a first open-circuit end and is designed by one of the frequencies of the two voltage signals and is extended to the open-circuit end from the feeding end to have a straight shape; and a second radiation path that has a second open-circuit end and is designed by the other one of the frequencies of the two voltage signals, is extended to the open-circuit end from the feeding end to have a "L" shape, a portion of the "L" shape being shared with the first radiation path, is bonded to the short end by extending the bonding end, and bonds the first radiation path to the short end, wherein each of the first radiation path and the second radiation path is used to radiate the two voltage signals corresponding to the two radiation paths and receive two electro-magnetic waves of a corresponding frequency fed from the outside,

the two voltage signals being fed to the ground unit through the short-end.

The utility model is implemented using the same design principle and further provides a three-frequency 5 reversed F-shaped antenna that is the reversed F-shaped antenna used for the notebook computer.

The features and operations of the exemplary embodiments of the utility model will be described in detail with reference to the accompanying drawings.

10

#### Description of the Drawings

FIG. 1 shows a first detailed embodiment of a double-frequency reversed F-shaped antenna according to the utility model;

15 FIG. 2 shows a second detailed embodiment of a double-frequency reversed F-shaped antenna according to the utility model;

20 FIG. 3 shows a third detailed embodiment of a double-frequency reversed F-shaped antenna according to the utility model; and

FIG. 4 shows a first detailed embodiment of a three-frequency reversed F-shaped antenna according to the utility model.

25 Detailed Description Of The Preferred Embodiments

In order to manufacture a double-frequency antenna or a multi-frequency antenna in such a manner that the antenna is built in portable electronic devices, such as a notebook computer, etc., the utility model adopts and designs a 5 reversed F-shaped antenna.

First, since the notebook computer built-in antenna has limited design space, the size of the antenna is limited, which should be necessarily made based on the directivity and radiation electromagnetic pattern generated 10 by the notebook computer. Since the notebook computer has recently become lightweight, slim, and small, the position where an embedded antenna can be mounted is limited to an edge portion of the notebook computer. Therefore, the antenna should be necessarily designed to be thin and long.

15 Hereinafter, as a detailed embodiment of the utility model, the double-frequency reversed F-shaped antenna according to the utility model will be described. FIG. 1 shows a first detailed embodiment configured based on a space with a thin and long shape of a notebook computer 20 using double-frequency of 2.4 G and 5.2 G as an example.

The double-frequency reversed F-shaped antenna 10 includes a feeding end 11, a first open-circuit end 12, a second open-circuit end 13, a short end 14, and a ground unit 15. The feeding end 11 is a bonding point of a signal line and 25 a high frequency signal (voltage) is fed from the feeding

end 11 to a first open-circuit end 12 and a second open-circuit end 13. The short end 14 is bonded to the ground unit 15 and a signal is fed from the first open-circuit end 12 and the second open-circuit end 13 to the short end 14  
5 and then again fed to the ground unit 15.

In designing, the first detailed embodiment of the utility model designs a path length of the open-circuit from the first open-circuit end 12 to the feeding end 11 to 1/4 of the wavelength (12.5 cm) that matches 2.4 GHz, that  
10 is, about 3 to 4 cm and the path length of the open circuit from the second open-circuit end 13 to the feeding end 11 to 1/4 of the wavelength (5.8 cm) that matches 5.2 GHz, that is, about 1.5 to 2 cm. As such, the voltage of the corresponding frequency is input through the feeding end 11,  
15 2.4 GHz can be radiated through the first open-circuit end 12 and the voltage of 5.2 GHz can be radiated through the second open-circuit end 13. To the contrary, when the electro-magnetic wave of the same frequency is received, the reversed F-shaped antenna receives the electro-magnetic  
20 wave of the corresponding frequency through the first open-circuit end 12 or the second open-circuit end 13 in the opposite scheme to the above-mentioned scheme of inputting the voltage of the frequency in order to sensitize the voltage input.

25 In addition, in order to increase the bandwidth of

the antenna, the open-circuit end is designed to have a relatively wide portion, such that it can increase the resonant frequency band. As shown in FIG. 1, the utility model increases the bandwidth by designing the position of 5 the open circuit of the first open-circuit end 12 in a relatively wide shape.

Actually, the shape of FIG. 1 is one of shapes that can be implemented. However, there are various schemes capable of installing the double-frequency reversed F-shaped antenna in the thin and long limited space of the above-mentioned notebook computer. FIG. 2 shows a detailed embodiment of a double-frequency reversed F-shaped antenna 10a of 2.4 G and 5.2 G by way of example. The path length is the same as FIG. 1, but FIG. 2 is different from FIG. 1 10 in that a relative position of the first opening end and 15 the second opening end is different from each other.

As described above, in order to increase the bandwidth of the high frequency portion of the detailed embodiment of FIG. 2, the portion of a second opening end 20 13' is designed to be relatively wide as shown in FIG. 3. Other limitation conditions of a double-frequency reversed F-shaped antenna 10b are the same as FIG. 1 and therefore, they will be omitted.

As can be appreciated from the above description, the 25 double-frequency reversed F-shaped antenna can be

manufactured through a path plan of the feeding end and the opening end. Similarly, in order to manufacture the multi-frequency reversed F-shaped antenna, the same design scheme can be used. FIG. 4 shows the first detailed embodiment of 5 the multi-frequency reversed F-shaped antenna according to the utility model. The multi-frequency reversed F-shaped antenna is designed to have three radiation frequencies by using three opening ends.

A three-frequency reversed F-shaped antenna 20 10 includes a feeding end 21, a first open-circuit end 22, a second open-circuit end 23, a third open-circuit end 24, a short end 25, and a ground end 26. The feeding end 21 is a bonding point of a signal line and a high frequency signal (voltage) is fed from the feeding end 21 to a first open-circuit end 22, a second open-circuit end 23, and a third open-circuit end 24. The short end 25 is bonded to the ground unit 26 and a signal is fed from the first open-circuit end 22, the second open-circuit end 23, and the third open-circuit end 24 to the short end 25 and then 15 again fed to the ground unit 26. 20

In designing, the second detailed embodiment of the utility model designs a path length of the open-circuit from the first open-circuit end 22 to the feeding end 21 to 1/4 of the wavelength (12.5 cm) that matches 2.4 GHz, that 25 is, about 3 to 4 cm, the path length of the open-circuit

from the second open-circuit end 23 to the feeding end 21 to 1/4 of the wavelength (5.8 cm) that matches 5.2 GHz, that is, about 1.5 to 2 cm, and a path length of the open circuit from the third open-circuit end 24 to the feeding end 21 to 1/4 of the wavelength (16.6 cm) that matches 1.8 GHz, that is, about 4 to 5 cm. As such, the voltage of the corresponding frequency is input through the feeding end 21, 2.4 GHz can be radiated through the first open-circuit end 22, the voltage of 5.2 GHz can be radiated through the 10 second open-circuit end 23, and the voltage of 1.8 GHz can be radiated through the third open-circuit end 24. To the contrary, when the electro-magnetic wave of the same frequency is received, the multi-frequency reversed F-shaped antenna receives the electro-magnetic wave of the 15 corresponding frequency through the first open-circuit end 22, the second open-circuit end 23, or the third open-circuit end 24 in the opposite scheme to the above-mentioned scheme of inputting the voltage of the frequency in order to sensitize the voltage input.

20 Similarly, in order to increase the bandwidth of the antenna, the open-circuit end is designed to have a relatively wide portion, such that it can increase the resonant frequency band. In addition, when selecting the frequency, frequencies such as 0.9 GHz, 1.6 GHz, 1.8 GHz, 25 2.0 GHz, 2.4 GHz, and 5.2 GHz, etc. can be selected and the

reversed F-shaped antenna can be designed according to the radiation length necessary for each frequency.

The reversed F-type antenna according to the utility model can be mounted in the portable electronic devices such as the notebook computer and the effect using the double-frequency, in particular, the multi-frequency radio technology can be achieved in the limited space of the notebook computer.

The utility model describes the exemplary embodiments as described above limited to the configuration and method of the embodiments described as above, but is not limited to the embodiments. Various changes or modifications can be made by a person having ordinary skill in the art to which the utility model pertains without departing from the spirit and scope of the utility model and therefore, it is construed that the right scope of the utility model is on the basis of the claims.

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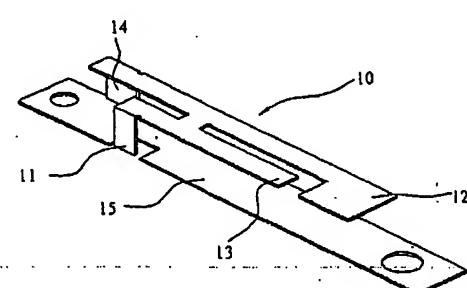
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[54] 实用新型名称 倒 F 型天线

[57] 摘要

本实用新型涉及一种倒 F 型天线，在笔记本计算机的空间限制下，本实用新型通过倒 F 型天线的设计，将双频或三频的天线开路端加以计算其路径长度，在依据笔记本计算机的空间限制，来设计出双频倒 F 型天线；开路端至信号馈入端的路径长度即为天线欲发射波长的 1/4，不同频率的天线，其路径长度不同。



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1. 一种倒 F 型天线，用于一笔记型计算机的无线电接收与发射并依据该笔记型计算机的可辐射边缘加以设计的双频天线，其特征在于，所述天线包括：

- 5 一馈入端，与一信号源相连接，信号源的电压信号从馈入端馈入；  
一短路端，与一接地部相连接，电压信号输出至该接地部；及  
一第一辐射路径，具有一第一开路端，依据该两个电压讯号的频率之一而设计，由该馈入端延伸至该开路端而形成一直线形；及  
一第二辐射路径，具有一第二开路端，依据该两个电压讯号的频率之  
10 另一个而设计，由该馈入端延伸至该开路端而形成一“L”形，该“L”形的一部份与该第一辐射路径共有，且该第二辐射路径并延伸一连接段以连接至该短路端，该第一辐射路径与该短路端导接；  
其中，该第一辐射路径与该第二辐射路径分别辐射相应于该两个辐射路径的该两个电压讯号与接收由外界传来相应频率的两个电磁波，该两个  
15 电压讯号并经由该短路端传回该接地部。

2. 如权利要求 1 所述的倒 F 型天线，其特征在于，所述该两个辐射路径的面积大小可调整。

3. 如权利要求 1、2 所述的倒 F 型天线，其特征在于，所述可调整该第一、二辐射路径的开路端形状为方形。

20 4. 如权利要求 1 所述的倒 F 型天线，其特征在于，所述两个电压讯号频率由 0.9GHz、1.6GHz、1.8GHz、2.0GHz、2.4Gz 与 5.2GHz 任选其二。

5. 一种三频倒 F 型天线，用于一笔记型计算机的无线电接收与发射并依据该笔记型计算机的可辐射边缘加以设计，其特征在于，所述天线包括：

25 一馈入端，与一信号源相连接，信号源的电压信号从馈入端馈入；

- 一短路端，与一接地部相连接，电压信号输出至该接地部；及  
一第一辐射路径，具有一第一开路端，依据该三个电压讯号的频率之  
一而设计，由该馈入端延伸至该开路端而形成一直线形；及  
一第二辐射路径，具有一第二开路端，依据该两个电压讯号的频率之  
5 二而设计，并由该馈入端延伸至该开路端而形成一直线形；  
一第三辐射路径，具有一第三开路端，依据该两个电压讯号的频率之  
三而设计，并由该馈入端延伸至该开路端而形成一“L”形，该“L”形  
的一部份与该第一、第二辐射路径共有，且该第三辐射路径并延伸一连接  
段以连接至该短路端，该第一、第二辐射路径与该短路端导接；  
10 其中，该第一、第二与第三辐射路径分别辐射相应于该三个辐射路径  
的该三个电压讯号与接收由外界传来相应频率的三个电磁波，该三个电压  
讯号并经由该短路端传回该接地部。  
三个具有一开路端的辐射路径，其路径长度依据该三个电压讯号的频  
率而设计并为由该馈入端起至该三个开路端为止，辐射相应于该三个辐射  
15 路径的该三个电压讯号与接收由外界传来相应频率的三个电磁波，该三个  
电压讯号并经由该短路端传回该接地部。  
6. 如权利要求 5 所述的三频倒 F 型天线，其特征在于，所述三个辐  
射路径的面积大小可调整。  
7. 如权利要求 1 所述的倒 F 型天线，其特征在于，所述可调整该第  
20 二、三辐射路径的开路端形状为方形。  
8. 如权利要求 1 所述的倒 F 型天线，其特征在于，所述可调整该第  
三辐射路径的开路端形状为方形。  
9. 如权利要求 5 所述的三频倒 F 型天线，其特征在于，所述三个电  
压讯号频率由 0.9GHz、1.6GHz、1.8GHz、2.0GHz、2.4Gz 与 5.2GHz 中任  
25 选其三。

## 倒 F 型天线

### 技术领域

5 本实用新型涉及一种天线，特别是涉及一种倒 F 型天线，应用于笔记本计算机的双频倒 F 型天线。

### 背景技术

目前，市面上的通讯产品有逐渐微小化的趋势，如行动电话的微小化。并且，通讯产品也逐渐与其它电子产品整合，例如，将通讯装置装设  
10 于笔记本计算机、个人数字助理等。此一额外的装置装设于电子产品时，势必要将其微小化。而目前众家厂商所推行的蓝芽(Blue Tooth)与无线通讯网路(Wireless LAN)，其所作的承诺，更期望将通讯装置与所有电子装置加以整合。蓝芽的发展，势必更将此一通讯产品微小化的趋势推上高峰。

15 如此的通讯技术发展趋势，有一个重要的因素必须纳入考虑，即天线。随着通讯装置的微小化，天线的设计也必然地必须相应地微小化。而天线微小化的解决方案，在现有技术当中，已为成熟的发展领域。例如，微带天线(薄型天线)、倒 F 型天线、高介电常数天线、利用隙缝或嵌入的天线与小型螺旋形天线等等，均为适应天线微小化所发展出的技术。

20 此外，为了增加频宽，通讯装置所设定的频率范围也越来越广，并且，有往高频领域迈进的趋势。以上述的蓝芽为例，其基频为 2.4GHz，而 GSM 则采用 1.8GHz 的基频等。高频的发展，更使得天线必须微小化。

此外，为了适应频带的广泛，研发人员为了让单一通讯装置能在多个频道下工作，也使得双频，甚至多频的通讯装置成为重要的研发目标。  
25 于是，各式各样的解决方案出笼。其中，如何让微小化的天线能够具有双

频甚至多频的工作频率，成为研发人员纷纷尝试解决的研发课题。

其中，如笔记本计算机等可携型电子设备，其都有许多金属结构，这些金属结构会形成电磁干扰(EMI)屏蔽，而将天线的辐射加以反射。所以，在设计内建于笔记本计算机当中的天线时，就必须要考虑更多的因素，  
5 其与自由空间设计天线将有相当大的不同与困难点，在频率、特性与场型都会改变。所以，设计具有双频或多频的笔记本计算机的内建天线，更显得困难许多。

### 发明内容

鉴于以上现有技术的问题，本实用新型的主要目的在于提供一种倒 F  
10 型天线，其可运用在笔记本计算机当中，并依实际需求设计为双频带或多频带的天线。

本实用新型的另一目的在于提供一种倒 F 型天线，通过调整辐射路径的面积大小，实现阻抗平衡匹配。

本实用新型的另一目的在于提供一种倒 F 型天线，通过调整辐射路径的面积大小，增加频宽。  
15

为达上述目的，本实用新型提供一种倒 F 型天线，系用于一笔记型计算机的无线电接收与发射并依据该笔记型计算机的可辐射边缘加以设计的双频天线，其包括有：馈入端，与一讯号源相连接，用以馈入两个电压讯号；短路端，与一接地部相连接，用以输出该两个电压讯号至该接地部；第一辐射路径，具有一第一开路端，系依据该两个电压讯号的频率之一而设计，并由该馈入端延伸至该开路端而形成一直线形；以及，第二辐射路径，具有一第二开路端，系依据该两个电压讯号的频率之另一个而设计，并由该馈入端延伸至该开路端而形成一“L”形，该“L”形的一部份系与该第一辐射路径共有，且该第二辐射路径并延伸一连接段以连接至  
20 该短路端，并使该第一辐射路径与该短路端导接；其中，该第一辐射路径  
25

与该第二辐射路径用以分别辐射相应于该两个辐射路径的该两个电压讯号与接收由外界传来相应频率的两个电磁波，该两个电压讯号并经由该短路端传回该接地部。

此外，本实用新型更提出一种三频倒 F 型天线，运用相同的设计原 5 理来实现用于笔记型计算机的倒 F 型天线。

有关本实用新型的特征与实作，配合附图作最佳实施例详细说明如 下。

### 附图说明

图 1 为本实用新型的双频倒 F 型天线的第一具体实施例；

10 图 2 为本实用新型的双频倒 F 型天线的第二具体实施例；

图 3 为本实用新型的双频倒 F 型天线的第三具体实施例；及

图 4 为本实用新型的三频倒 F 型天线的第一具体实施例。

### 具体实施方式

为了要让笔记型计算机等可携式电子装置能够以内建的方式来制作 15 双频以上的天线，本实用新型采用倒 F 型天线来设计。

首先，笔记型计算机的内键天线，其设计空间有限，所以，天线的尺度受到局限，而必须依据笔记型计算机所欲产生的辐射场型与指向性来做考虑。由于笔记型计算机逐渐趋向轻薄短小，于是，内建型天线的可摆设位置遂限制于笔记型计算机的边缘部分，这使得天线必须设计为细长型。

20 以下，本实用新型将以具体实施例来说明本实用新型的双频以上的倒 F 型天线。请参考图 1，其为以 2.4G、5.2G 的双频为例，并依据笔记型计算机的细长型空间限制所制作出恩人第一具体实施例。此双频倒 F 型天线 10 包括了几个部分：馈入(feed)端 11、第一开路端 12、第二开路端 13、短路(short)端 14 与接地部 15。其中，馈入端 11 即为讯号线的连接 25 点，高频讯号(电压)由馈入端 11 传输至第一开路端 12 与第二开路端 13；

短路端 14 则连接到接地部 15，讯号最后会由第一开路端 12 与第二开路端 13 传至短路端 14，最后再传至接地部 15。

在设计上，本实用新型的第一具体实施例将第一开路端 12 至馈入端 11 的开路路径距离设计为符合 2.4GHz 的  $1/4$  波长(12.5 公分)，即，约 5 3--4 公分左右；第二开路端 13 至馈入端 11 的开路路径距离则设计为符合 5.2GHz 的  $1/4$  波长(5.8 公分)，即，约 1.5--2 公分。如此，由馈入端 11 输入相应频率的电压时，如 2.4GHz 可通过第一开路端 12 辐射，5.2GHz 的电压可通过第二开路端 13 辐射。反之，在接收同样频率的电磁波时，即以反向的方式经由第一开路端 12 或第二开路端 13 接收相应频率的电磁 10 波，而感应为电压输入。

此外，为了增加天线的频宽，可以再开路端设计一些较宽的部分，以增加开路端可共振的频率范围。如图 1 所示，本实用新型即将第一开路端 12 的开路位置设计出一较宽的形状，以达到频宽增加的目的。

事实上，图 1 的形状只是可行方案的其中一种，以上述的笔记型计算机的细长限制来讲，要达到双频的倒 F 型天线，仍有多种可行方案。请继续参考图 2，其为以 2.4G、5.2G 的双频倒 F 型天线 10a 为例，所制作出的第二具体实施例。其路径长度皆与图 1 所谈者相同，唯一不同的是第一开口端与第二开口端的相对位置不同。

此外，如上所述，若要增加图 2 的具体实施例的高频部分的频宽，可 20 同样在第二开口端 13' 的部分设计一较宽的部分，如图 3 所示。此双频倒 F 型天线 10b 的其余限制条件与图 1 所言者相同，不再赘述。

从上述可知，通过倒 F 型天线馈入端与开口端的路径规划，即可制作出双频倒 F 型天线。同样地，要制作出多频倒 F 型天线，亦可运用同样的设计方式。请参考图 4，其为本实用新型多频倒 F 型天线的第一具体实施 25 例，其为运用三个开口端的设计，来达到三个辐射频率的目的。

此三频倒 F 型天线 20 包括了几个部分：馈入端 21、第一开路端 22、第二开路端 23、第三开路端 24、短路端 25 与接地部 26。其中，馈入端 21 即为讯号线的连接点，高频讯号(电压)由馈入端 21 传输至第一开路端 22、第二开路端 23 与第三开路端 24；短路端 25 则连接到接地部 26，讯号最后会由第一开路端 22、第二开路端 23 与第三开路端传至短路端 25，最后再传至接地部 26。

在设计上，本实用新型的第二具体实施例将第一开路端 22 至馈入端 21 的开路路径距离设计为符合 2.4GHz 的  $1/4$  波长(12.5 公分)，即，约 3--4 公分；第二开路端 23 至馈入端 21 的开路路径距离则设计为符合 10 5.2GHz 的  $1/4$  波长(5.8 公分)，即，约 1.5--2 公分；第三开路端 24 至馈入端 21 的开路路径距离则设计为符合 1.8GHz 的  $1/4$  波长(16.6 公分)，即，约 4--5 公分。如此，由馈入端 21 输入相应频率的电压时，如 2.4GHz 可通过第一开路端 22 辐射；5.2GHz 的电压可通过第二开路端 23 辐射；1.8GHz 的电压极可通过第三开路端 24 辐射。反之，在接收同样频率的电 15 磁波时，即以反向的方式经由第一开路端 22、第二开路端 23 或第三开路端 24 接收相应频率的电磁波，而感应为电压输入。

同样地，要增加天线的频宽，可以再开路端设计一些较宽的部分，以增加开路端可共振的频率范围。此外，在频率的选择上，则可选择 0.9GHz、1.6GHz、1.8GHz、2.0GHz、2.4Gz 与 5.2GHz 等频率，并依照个频率所需 20 的辐射长度来加以设计倒 F 型天线。

本实用新型的倒 F 型天线，可装置于笔记型计算机等可携式电子装置上，而达到在笔记型计算机的有限空间中，运用双频甚至多频无线技术的效果。

虽然本实用新型以前述的较佳实施例公开如上，然其并非用以限定本 25 实用新型，任何本领域普通技术人员，在不脱离本实用新型的精神和范围

内，当可作些许的更动与润饰，因此本实用新型的专利保护范围以权利要求为准。

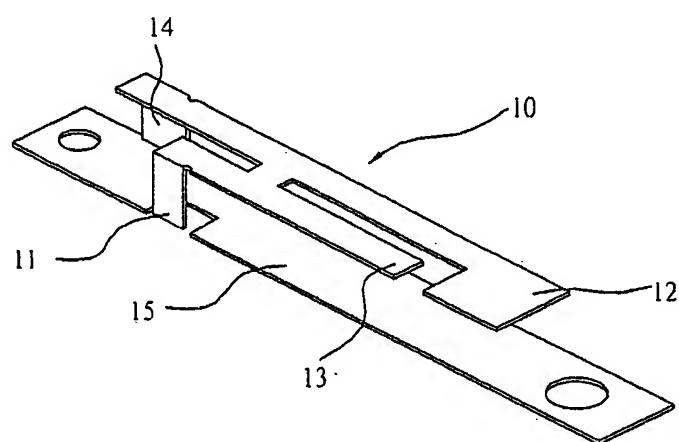


图1

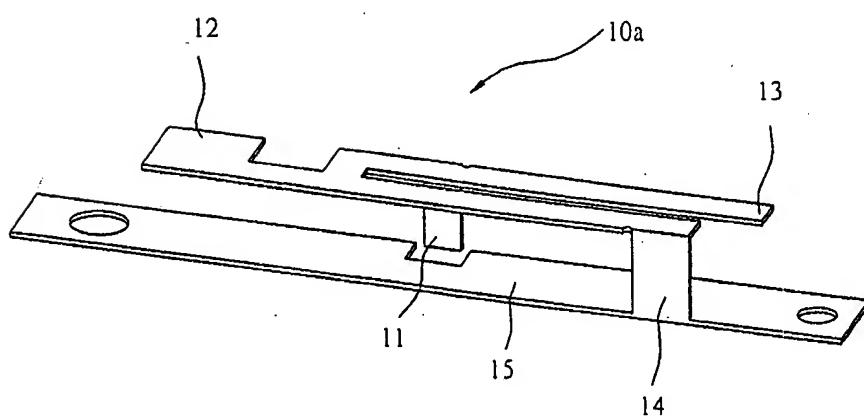


图2

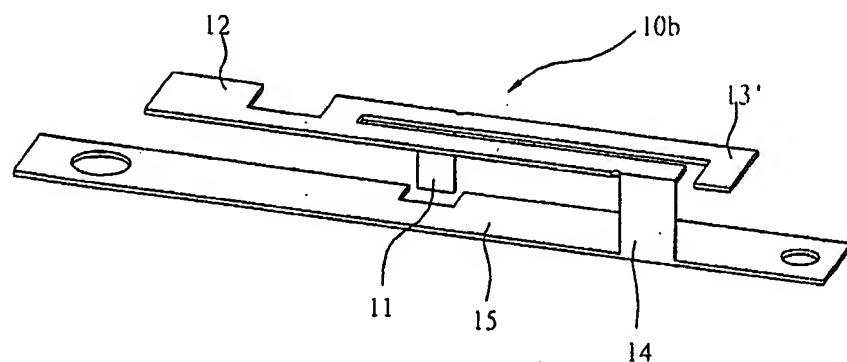


图3

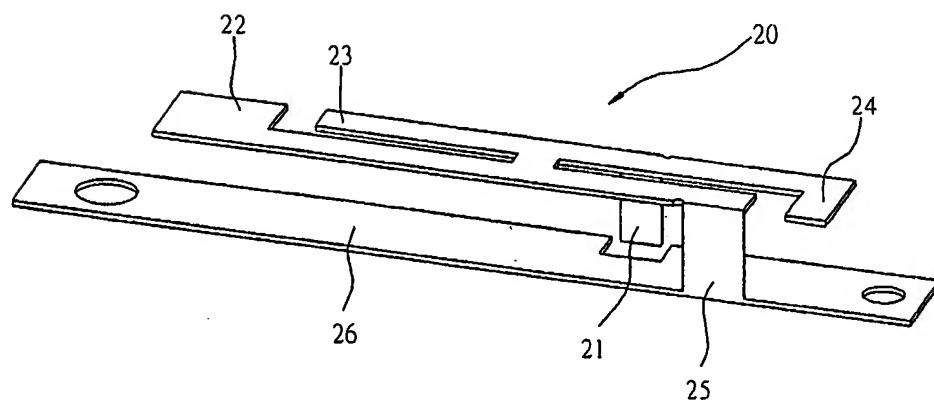


图4